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Information Programs Affect Attitudes Toward Sewage Sludge Use in Agriculture

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16. ABSTRACT

A survey was conducted of rural farmers, rural nonfarmers, urban and suburban residents to determine attitudes toward land application of sludge. After a thorough educational meeting devoted to a discussion of benefits and risks in sludge use, the groups were again quizzed and the answers compared to assess the effectiveness of the educational program. It was found that farmers who had used sludge, or were acquainted with its use, were more amenable to its use than those with no prior experience with it. There was also some correlation with sex and age. Women and people over 65 are less receptive to sludge use than younger men. Educational meetings changed attitudes significantly among those who participated, but attendance was low even though the meetings were publicized.

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FOREWORD

The U.S. Environmental Protection Agency was created because of increasing public and government concern about the dangers of pollution to the health and welfare of the American people. Noxious air, foul water, and spoiled land are tragic testimonies to the deterioration of our natural environment. The complexity of that environment and the interplay of its components require a concentrated and integrated attack on the problem.

Research and development is that necessary first step in problem solution; it involves defining the problem, measuring its impact, and searching for solutions. The Municipal Environmental Research Laboratory develops new and improved technology and systems to prevent, treat, and manage wastewater and solid and hazardous waste pollutant discharges from municipal and community sources, to preserve and treat public drinking water supplies, and to minimize the adverse economic, social, health, and aesthetic effects of pollution. This publication is one of the products of that research and provides a most vital communications link between the researcher and the user community.

The ability to make objective decisions about waste utilization or disposal is often limited by the information avialable. This report describes an attempt to examine the attitudes of residents of various communities toward land application of sludge and to determine the influence of educational meetings on those attitudes.

Francis T. Mayo, Director
Municipal Environmental Research
Laboratory

ABSTRACT

The concept of land application of sewage sludge on farmland is not new--it has been used for centuries in Asia and Europe. In the United States, farmers continue the practice of recycling animal wastes, and this practice is accepted by society. Generally speaking, however, the practice of recycling treated human wastes is not readily accepted.

Several communities in Ohio have successfully established land application programs while others have encountered serious problems of public acceptance. Opposition arises over various concerns about potential health and environmental side effects of land application. The real problem seems to be whether or not people will accept this method of disposal and, if so, under what conditions.

In this research we have attempted to examine the attitude of Ohio residents toward land application and to determine the influence of educational meetings on those attitudes. The general methodology involved: (1) a survey of community knowledge and attitudes regarding sludge and its application to farmland; (2) development and implementation of a land application educational program; (3) assessment of the effectiveness of the educational programs on participants' knowledge and attitudes.

Briefly, our analysis indicates that females are much more negative than males in their reaction to the use of sludge. Farmers who have used sludge are more favorable to its use than those who have not used it. And, finally, people who know the definition of sludge have a more favorable reaction to its use.

Educational meetings proved to be an effective means of improving participants' attitudes and acceptance of land application. However, even with extensive meeting publicity, only a small number of community members will attend such meetings. Land application is not likely to become a topic of great interest until a land application program is imminent. Obviously, there is still a need to increase community awareness of the facts about land application. If educational meetings are not the most efficient way, it is suggested that more efficient methods may be informational pamphlets, films and slide programs, and speakers' bureaus.

This report was submitted in fulfillment of Grant No. R804703 by the Ohio Farm Bureau Development Corporation under the sponsorship of the U. S. Environmental Protection Agency. This report covers the period of October 6, 1976 to July 5, 1979, and work was completed as of October 5, 1978.

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Finally, there are other individuals, too numerous to mention here, who provided assistance to the project. These included personnel within the Ohio Farm Bureau Federation, local waste water treatment personnel, members of the local news media who helped to advertise the educational meetings, and others. While they cannot be mentioned here by name, the appreciation for their help is no less sincere.

SECTION 1

INTRODUCTION

Application of sewage sludge to farmland is expected to become increasingly important during the next few years. Municipal waste managers are faced with ever-increasing costs for alternative methods of sludge disposal, such as incineration, as well as Federal requirements to implement more cost-effective disposal. Furthermore, sewage sludge, properly applied to agricultural land, may provide several important benefits to farmers.

Several communities in Ohio have successfully established programs for land spreading of sewage sludge. Some communities, however, have encountered serious problems of public opposition. Public opposition seems to arise over various concerns about possible health and environmental side effects of land application. The purpose of the project reported herein was to examine the attitudes of Ohio residents regarding land application of sewage sludge and to determine the influence of educational programs on those attitudes.

OBJECTIVES

The objectives of this project were:

- To determine community attitudes and information needs regarding sludge and the application of sludge to farm land
- To develop an educational program to fill the community information needs in the area of sludge application
- To determine the effect of the educational program on the knowledge and attitudes of program participants about sludge application.

SECTION 2

CONCLUSIONS AND RECOMMENDATIONS

An educational program, such as the one used in this study, appears to be an effective means of improving participants' attitudes and acceptance of land application. A possible problem associated with educational meetings is the anticipated small number of community members who will attend such meetings, in spite of extensive meeting publicity. Land application does not appear to be a topic of great interest to large numbers of community members. At least, it is not of sufficient interest to reach large numbers of people via meetings. It is not likely to become a topic of great interest until a land application program is imminent, and even then will probably be of greatest concern to those people living in the immediate area of land application.

This lack of general interest in land application, until a project is imminent, presents a dilemma, because an education/information program which is initiated only in response to expressed community interest is likely to come at a time which is too late to deal with unwarranted community fears in a most effective manner. Therefore, the following recommendations are made.

There is a need to increase general community awareness of the facts of land application. Educational meetings, in general, are not the most efficient way to increase awareness, due to the lack of interest and the ensuing low attendance at meetings. This indicates that more efficient methods for reaching the general public may be:

- Small, easily read information pamphlets which can be distributed to community groups via a variety of distribution mechanisms (e.g., county fairs, direct mailings, displays in public places, etc.)

- A film on land application should be produced which can be used by school systems, 4-H clubs, and other community organizations.

- A speaker's bureau should be established to provide speakers on land application to community organizations who frequently seek topics for their meetings. A number of "captive audiences" can be reached in this way.

When a land application program is to be instituted in a community, a more intensive educational program, using advertised public meetings, may be warranted. Care must be taken that these meetings are timed to both take

advantage of community interest and to prevent the development of unwarranted fears and ingrained opposition. Public meetings have the advantage of providing adequate time to answer specific questions and concerns. Also, there is an added benefit of individuals being able to hear and assess the views of other community members. It should be remembered, in developing such public meetings, that survey results show that special educational attention should be directed to female members of the community. Also, farm residents who have used sludge in the past are an excellent source of information which can be utilized to inform other members of the community regarding the facts of land application.

SECTION 3

APPROACH

The general methodology utilized in this study involved: (1) a survey of community attitudes and knowledge regarding land application; (2) development and implementation of a land application education program; and, (3) assessment of the effectiveness of the educational program. These products are discussed in the major sections of this report.

SURVEY OF COMMUNITY ATTITUDES AND KNOWLEDGE

Included in the survey of community attitudes and knowledge were the following steps:

- o Selection of communities for participation in the survey
- o Identification of participant groups
- o Development of the attitude/cognitive survey instrument
- o Selection of the survey sample
- o Implementation of the survey procedures
- o Analysis of survey results.

Selection of Communities for Participation in the Survey

Six Ohio communities were originally planned for participation in the study. Four of these communities had already been identified at the inception of the project. These four communities were Defiance (Defiance County); the Montgomery County Sanitation District; Zanesville (Muskingum County); and the Medina County Sanitation District. Each of these communities was initially selected because of its anticipated participation in the Ohio Farm Bureau Federation's proposed demonstration project on the management of sewage sludge spreading on farmland.[1]

---

[1] "Demonstration Project to Show Ohio Land Owners and Municipalities Acceptable Systems for Applying Sludge on Land." This project is subsequently referred to in this report as the "demonstration project." It should not be confused with the project which is the subject of this report and which is subsequently referred to as the "education project."

Two additional communities, which did not need to have a sewage sludge demonstration project, were to be selected. One of these communities was to be a large metropolitan area and the second was to be a smaller industrial city. The large metropolitan area selected for the education project was the City of Columbus (Franklin County). The small, industrial city which was selected was the City of Jackson (Jackson County).

In addition to these six counties, it was subsequently decided to add Greene County, which is adjacent to Montgomery County and which would be a possible site for land application in the demonstration project. Subsequently, it became questionable whether or not Montgomery County would agree to participate in the demonstration project. Therefore, the City of Columbus (Franklin County) was picked as an alternative to Montgomery County as a large metropolitan area, for participation in the demonstration project. In view of the fact that a land application demonstration project for the City of Columbus would also involve Pickaway County (adjacent to Franklin County on the south), Pickaway County was also selected for participation in the education project.

Therefore, a total of eight Ohio counties were selected for participation in this study. These counties were selected for the attitudinal/cognitive survey and for the education meetings. They are:

- Defiance County
- Montgomery County
- Greene County
- Muskingum County
- Medina County
- Jackson County
- Franklin County
- Pickaway County

Preliminary visits were made to several of these communities to provide general information about the project to sewage treatment plant personnel, agricultural extension personnel, etc. Where applicable, information relevant to the identification of participant groups and to the development of the survey instrument items was obtained.

Identification of Participant Groups

Participant groups were identified. These participant groups were selected on the basis of individual or unique community groups which may be differently affected by a land application program. Three basic groups were identified. They are: (1) farm; (2) non-farm rural; and, (3) urban or suburban. It was anticipated that the specific attitudes of members of these

three groups regarding a land application program may differ, dependent on membership in one or another of these groups.

Additionally, within each of these three groups, it was anticipated that the attitudes of the male population and the attitudes of the female population regarding land application might differ. Therefore, these two population characteristics, namely: (1) place of residence (farm, non-farm rural, urban or suburban), and, (2) sex, were utilized in selection of the sample and in distribution of the survey instrument.

Development of the Attitude/Cognitive Survey Instrument

A survey instrument was developed to determine: (1) the attitudes of Ohio residents regarding land application; (2) their current level of knowledge regarding municipal sewage sludge and land application; and, (3) their interest in knowing more about a variety of topics regarding sewage sludge and land application. The survey instrument was developed on the basis of: (1) a review of the literature on sewage sludge and land application; and, (2) discussion with knowledgeable individuals and experts regarding the topic. Following development of the initial survey instrument, a pilot test was conducted on a small sample of respondents to verify the clairty of the instructions, the clarity of the questionnaire items, and to assure that the length of time required to respond to the questionnaire was not excessive. This pilot test was conducted with several farm (rural) and non-farm (urban) individuals, both male and female. It was conducted on an individual, or one-to-one, basis in order to obtain detailed feedback regarding the adequacy of the survey instrument. Revisions to the survey instrument were made subsequently, based upon the information obtained during the pilot test.

The survey instrument consists of three basic parts. They are: (1) identification, demographic and background information items (Items 1-10); (2) attitudinal items (Items 11-34); and, (3) knowledge and interest items (Items 35-75). Copies of the survey instrument and an accompanying cover letter were printed.

Selection of the Sample

Sample selection utilized county directories or Farm Bureau membership lists and local telephone directories. For those counties for which a county directory was available, an attempt was made to choose resident names in the various county townships in the same proportion to township population as indicated in 1970 census data. In instances where a particular township was heavily urbanized, it was not possible to choose an adequate number of farm or non-farm rural residents from that township. In this instance, a larger number of farm or non-farm rural residents were chosen from the surrounding townships. Likewise, it was sometimes impossible to select an adequate number of urban/suburban residents from a very rural township. In general, however, samples selected from counties which had a county directory represent all of the townships within the county. Each sample (i.e. farm, non-farm rural, and urban/suburban) was selected on a random basis. For those counties for which a county directory was available, approximately

two hundred farm families were selected (100 male addresses and 100 female addresses) using the "farm" notation found with the address and other resident information. Likewise, approximately 200 non-farm rural residents were selected for each county by: (1) using a county map to locate rural areas of the county; (2) selecting roads within the rural areas; and, (3) selecting residents from the "street index" of the county directory. Only residents who did not have a "farm" indicator were selected for the non-farm rural group. For each county for which a directory was available, approximately 200 urban/suburban residents were selected from the county directory using the street index or the separate index for large urban areas.

For those counties for which a county directory was not available, farm and non-farm rural resident groups were randomly selected from Farm Bureau membership lists. The urban/suburban resident group was selected from the telephone directory of the principal municipality in the county.

Survey Procedures

The Farm Bureau Municipal Sewage Sludge questionnaire was sent out to 4800 people. Six hundred people in each of the eight Ohio counties (Defiance, Franklin, Greene, Jackson, Medina, Montgomery, Muskingum and Pickaway) were sent questionnaires. As stated previously, in each county an equal number were sent to people who live on a farm, people who live in a rural area but not on a farm, and people who live in an urban or suburban environment. There were 200 people in each subgroup. (Each subgroup contained 100 males and 100 females.) Enclosed in the survey package were: the questionnaire, the cover letter and a Farm Bureau business reply envelope. After approximately three weeks a post card was sent, as a reminder, to those people who had not responded. After an additional three weeks a second questionnaire and a new cover letter was sent to the non-respondents. In all, 1397 (29.1%) usable questionnaires were returned using this three contact approach. Table 1 shows the number of returns for each of the eight counties and for each of the 3 residential groupings (it should be noted that 12 cases had missing data for either county or residential grouping). Table 2 shows the percent of usable returns for each subgroup as well as for each county, for each residential grouping and for the total sample. Here it can be seen that the largest rates of return were from Franklin County, 47.2% and from people who live on a farm, 43.0%. The subgroups with the three largest rates of return were people who live on a farm in Greene County, 68.0%; people who live on a farm in Franklin County, 62.0%; and people who live in an urban or suburban environment in Franklin County, 59.0%. The lowest rate of returns were from Defiance County, 16.5%, and for people who do not live on a farm, but do live in a rural environment, 14.8%. The subgroups with the lowest returns are non-farm rural in Defiance County, 9.5%; non-farm rural in Montgomery County, and urban or suburban in Defiance County, 10.5%; and non-farm rural in Jackson County, 12.0%. It should be mentioned here that place of residence--farm, non-farm rural, urban or suburban--was self-coded and, as such, the data does not indicate whether a given respondent thought he belonged to the same residential group as that in which he was placed during sample selection. The non-farm rural group is probably affected most by this factor. It is possible that some members of this group viewed themselves as suburban residents.

TABLE 1. NUMBER OF QUESTIONNAIRES RETURNED

County	Place of residence			
	Farm	Non-farm rural	Urban or suburban	Total
MEDINA	96	27	34	157
DEFIANCE	59	19	21	99
FRANKLIN	124	41	118	283
GREENE	136	32	68	236
JACKSON	72	24	66	162
MUSKINGUM	66	34	37	137
MONTGOMERY	66	21	74	161
PICKAWAY	69	39	42	150
TOTAL	688	237	460	1385

TABLE 2. PERCENT OF QUESTIONNAIRES RETURNED*

County	Place of Residence			
	Farm	Non-farm rural	Urban or suburban	Total**
MEDINA	48.0	13.5	17.0	26.2
DEFIANCE	29.5	9.5	10.5	16.5
FRANKLIN	62.0	20.5	59.0	47.2
GREENE	68.0	16.0	34.0	39.3
JACKSON	36.0	12.0	33.0	27.0
MUSKINGUM	33.0	17.0	18.5	22.8
MONTGOMERY	33.0	10.5	37.0	26.8
PICKAWAY	34.5	19.5	21.0	25.0
TOTAL***	43.0	14.8	28.8	28.9****

* Each of the sub-group percentages are based on 200 questionnaires mailed.
** Each of the county percentages are based on 600 questionnaires mailed.
*** Each place of residence is based on 1600 questionnaires mailed.
**** The total is based on 4800 questionnaires mailed.

Analysis of Survey Results

The questionnaire that was used to determine the "Attitudes of Ohio Residents Toward the Land Application of Municipal Sewage Sludge" consisted of 75 questions. In addition to attitudinal questions, questions were also asked on knowledge of and interest in sludge; and on the respondents background. In the previous section, "Survey Procedures," and analysis was presented of the approximately 30% return rate (i.e., 1397 questionnaires). In this section an analysis of the various response categories of the 1397 respondents is presented. This analysis is divided into three sections: (1) background information; (2) attitudes; and, (3) knowledge and interest. A brief summary of survey conclusions is presented at the end of this section.

Background Information

The numbers and percents for each of the background variables: questions 1-10 are presented in Table 3 for reader review. It should be remembered that questions 2 (sex) and 4 (place of residence) were controlled in the original mail out. An analysis was made to determine the interrelatedness of some of these background variables. This analysis is discussed in the following pages.

A comparison was made, for people who live on a farm, between willingness to use sludge on their own farmland and several other variables. It was found, through a Chi Square Test of Significance, that this willingness to use sludge was not related to age, farming as a principal occupation, or size of farm. However, it was significantly related to sex (.0000) and experience with land application of sewage sludge (.0000). These significant results are presented in Table 4. The analysis presented in Table 4A shows the relationship between willingness to use sludge and being male or unwillingness to use sludge and being female. Table 4B shows that people who have not heard of sludge are more likely to say no to its usage (71.8% compared to the total of 52.0%), while people who have used it themselves are less likely to say no (20.8% compared to the total of 52.0%). The results of comparing willingness to use sludge with both sex and experience are shown in Table 4C. Here it can be seen that there is not a significant difference between males and females and their willingness to use sludge when it has been spread on their own land, or when it has been spread on a neighbor's land (i.e., personal contact with sludge). However, there are significant differences among willingness to use sludge, sex and having heard of sludge or not having heard of sludge. For the group which has not had personal contact (i.e., sludge has not been spread on their land nor on a neighbor's land), but has heard of sludge, males are significantly more willing to use sludge than females. For the people who have not heard of sludge only one out of five women would be willing to have it spread while slightly less than 1/2 of the males in this category would consent to its use. From this analysis, it can be seen that once someone has used sludge, they are willing to continue to use it, or to use it again. These results indicate that the group of people who have used sludge before might be utilized in a program to provide information on its use to other farmers. These results also indicate that some type of special education program on

TABLE 3. BACKGROUND VARIABLES: NUMBER AND PERCENT

Variable categories	Number	Percent
Age	1381	100.0
18-25	61	4.4
26-35	183	13.2
36-50	396	28.5
51-65	481	34.7
Over 65	267	19.2
Sex	1393	100.0
Male	698	50.1
Female	695	49.9
Are you a property owner or tenant?	1383	100.0
Property owner	1245	90.0
Tenant	138	10.0
Place of residence	1388	100.0
Farm	690	49.7
Non-farm, rural	238	17.1
Urban or suburban	460	33.1
My principal occupation is farming	1388	100.0
No	995	71.7
Yes	393	28.3
Total number of acres owned or farmed	1385	100.0
Less than 180 acres	261	18.8
101-300 acres	313	22.6
Over 300 acres	178	12.9
Do not live on a farm	633	45.7
Source of information regarding the land application of municipal sewage sludge	1384	100.0
Have attended educational meetings or programs on the land application of sewage sludge	20	1.4
Have read articles or brochures on the land application of sewage sludge	453	32.7
Both of the above	57	4.1
Have seen it in use	48	3.5
Other	70	5.1
No source of information	736	53.2
Experience with land application of sewage sludge	1380	100.0
Sludge has been spread on my land	65	4.7
Sludge has been spread on a neighbor's land or in the community	146	10.6
Have heard of the land application of sludge	745	54.0
Have not heard of the land application of sludge	424	30.7

(continued)

TABLE 3 (continued)

Variable categories	Number	Percent
Would you allow your land to be used for the landspreading of sludge?	1397	100.0
No	372	26.6
Yes	341	24.4
Don't know	71	5.1
Do not live on a farm	613	43.9
Definition of sewage sludge	1380	100.0
A product from municipal sewage treatment plants	1151	83.4
Septic tank pumpings	70	5.1
Raw, untreated sewage	93	6.7
Any animal waste materials	43	3.1
Other	23	1.7

TABLE 4. SIGNIFICANT INTERACTIONS WITH WILLINGNESS TO USE SLUDGE ON OWN FARM LAND

	Numbers			Percent		
	Not Willing	Willing	Total	Not Willing	Willing	Total
A. Sex						
Male	161	206	367	43.9	56.1	100.0
Female	210	135	345	60.9	39.1	100.0
Total	371	341	712	52.1	47.9	100.0
B. Experience with Land Application of Sewage Sludge						
Sludge has been spread on my land	10	38	48	20.8	79.2	100.0
Sludge has been spread on a neighbor's land or in community	53	51	104	51.0	49.0	100.0
Have heard of land application of sludge	187	204	391	47.8	52.2	100.0
Have not heard of land application of sludge	117	46	163	71.8	28.2	100.0
Total	367	339	706	52.0	48.0	100.0
C. Sex AND Experience with Land Application						
Sludge has been spread on my land						
Male	6	24	30	20.0	80.0	100.0
Female	4	13	17	23.5	76.5	100.0
Total	10	37	47	21.3	78.7	100.0
Sludge has been spread on a neighbor's land or in the community[a]						
Male	27	31	58	46.6	53.4	100.0
Female	21	13	34	61.8	38.2	100.0
Total	48	44	92	52.2	47.8	100.0
Have heard of land application of sludge[b]						
Male	80	112	192	41.7	58.3	100.0
Female	97	80	177	54.8	45.2	100.0
Total	177	192	369	48.0	52.0	100.0
Have not heard of land application of sludge[c]						
Male	34	26	60	56.7	43.3	100.0
Female	72	18	90	80.0	20.0	100.0
Total	106	44	150	70.7	29.3	100.0

a x^2 is not significant
b $x^2 = .0156$
c $x^2 = .0038$

land application should be directed to women who live on farms.

The variable concerning the source of information regarding the land application of municipal sewage sludge was also analyzed in detail. Here it was found, using a Chi-Square Test of Significance, that age was not significantly related, while both sex and place of residence were significantly related (X^2 = .0001 for both). Table 5 shows these significant interactions. In Table 5A it can be seen that 70.8% of the people who have seen sludge in use are males (males are 50.3% of the respondent population), while 64.9% of the people who have both attended meetings and read articles on the subject are males. Table 5B presents the interaction between source of sludge information and place of residence. Here one can observe an over-representation of people who live on a farm, with 59.6% who have both attended meetings and read articles on sludge (people who live on a farm make up 49.9% of the returned questionnaires). For the non-farm rural population, there is an over-representation of people who have attended educational meetings on the land application of sewage sludge, 30.0% of the people who have attended meetings compared to 17.1% of the total population. Conversely, the urban and suburban group is under represented with regard to these meetings, 20.0% compared to 33.0% of the total population. The remaining percentages appear to fall within normal limits.

Attitudes--

Attitudinal questions about sludge make another part of the questionnaire (Items 11 through 34). There are three parts within this attitudinal section. The first part concerns the primary reasons for land spreading of municipal sewage sludge (Items 11-13). The second part concerns reactions to the actual spreading of sewage sludge (Items 14-16). The third part concerns itself with general statements about sewage sludge (Items 17-34).

The three primary reasons for land application usage: to help the cities dispose of sludge, as a fertilizer and soil conditioner, and to help protect the environment, were analyzed in relation to place of residence and occupation. This analysis is presented in Table 6 which shows categorical means as well as frequency. Using both a Chi-Square for the frequency, and an analysis of variance for the means, the use of sludge to help the cities was not significantly related to either place of residence or occupation. But both other reasons for land application of sludge (i.e., as a fertilizer and to protect the environment) were significant when compared to place of residence and occupation. An analysis of the importance each group places on the fertilizer and soil conditioning value of sludge shows that farmers place a lower value on this than do non-farmers (respective means of 3.07 and 3.50); and that people who live on a farm place a lower value on sludge as a fertilizer than people who live in a non-farm rural environment or in an urban/suburban environment (respective means of 3.16, 3.56 and 3.60).

An analysis of the importance each group places on the landspreading of sludge to help protect the environment, since it could be a more environmentally acceptable means of disposal, shows that farmers place a lower value on this than non-farmers (respective means of 3.04 and 3.36). Likewise, people who live on a farm place a lower value on this than people

TABLE 5. SIGNIFICANT INTERACTIONS WITH SOURCE OF SLUDGE INFORMATION

	Attended meetings	Read articles	Both	Have seen it in use	Other	No source	Total
A. Sex*							
Male	10	252	37	34	30	332	695
Female	10	201	20	14	40	401	686
Total	20	453	57	48	70	733	1381
*Sex***							
Male	*50.0*	*55.6*	*64.9*	*70.8*	*42.2*	*45.3*	*50.3*
Female	*50.0*	*44.4*	*35.1*	*29.2*	*57.1*	*54.7*	*49.7*
Total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*
B. Place of Residence*							
Farm	10	263	34	26	34	320	687
Non-farm, rural	6	73	7	8	14	128	236
Urban or suburban	4	114	16	13	22	285	454
Total	20	450	57	47	70	733	1377
*Place of Residence***							
Farm	*50.0*	*58.4*	*59.6*	*55.3*	*48.6*	*43.7*	*49.9*
Non-farm, rural	*30.0*	*16.2*	*12.3*	*17.0*	*20.0*	*17.5*	*17.1*
Urban or suburban	*20.0*	*25.3*	*28.1*	*27.7*	*31.4*	*38.9*	*33.0*
Total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

* Regular type format indicates number.
** *Italic type format indicates percent.*

TABLE 6. PRIMARY REASONS FOR USING SLUDGE

A. Help the cities and sewage districts get rid of the sludge

	Not at all important	Slightly important	Moderately important	Very important	Of highest importance	Total	$\bar{X}$	X^2	X^2
Farm	58	69	140	244	134	636	3.51		
Non-farm rural	22	28	51	97	28	226	3.56	N.S.	N.S.
Urban and suburban	26	50	105	185	68	434	3.50		
Total	106	147	296	526	230	1305	3.48		
Non-farmer	68	109	221	393	147	938	3.47		
Farmer	35	38	76	137	80	366	3.52	N.S.	N.S.
Total	103	147	297	530	227	1304	3.48		

B. Take advantage of the fertilizer and soil conditioning value of the sludge

	Not at all important	Slightly important	Moderately important	Very important	Of highest importance	Total	$\bar{X}$	X^2	X^2
Farm	74	117	179	181	94	645	3.16		
Non-farm rural	12	30	57	78	52	229	3.56	.0000	.0000
Urban and suburban	31	38	98	175	93	435	3.60		
Total	117	183	334	434	239	1309	3.38		
Non-farmer	78	108	219	341	198	944	3.50		
Farmer	37	77	117	93	41	365	3.07	.0000	.0000
Total	115	185	336	434	239	1309	3.38		

C. Help protect the environment, since landspreading is a more environmentally acceptable means of disposal than other methods

	Not at all important	Slightly important	Moderately important	Very important	Of highest importance	Total	$\bar{X}$	X^2	X^2
Farm	98	112	156	178	86	630	3.07		
Non-farm rural	19	34	55	80	37	225	3.36	.0000	.0000
Urban and suburban	41	44	94	157	96	432	3.52		
Total	158	190	305	415	219	1287	3.27		
Non-farmer	102	127	208	317	175	929	3.36		
Farmer	54	63	99	98	44	358	3.04	.0000	.0000
Total	156	190	307	415	219	1287	3.27		

who live in a non-farm rural environment; and people who live in a non-farm rural environment place a lower value on this than people who live in an urban/suburban environment (respective means of 3.07 (farm), 3.36 (non-farm rural), and 3.52 (urban/suburban)). It is interesting to note that when the means are compared within groups for all three reasons, the farmers indicate they will use sludge principally to help the cities, with a mean of 3.52 for this reason, compared with a mean of 3.07 for sludge's use as a fertilizer and a mean of 3.04 for landspreading as a way of helping the environment. The non-farmers indicate that sludge should be used principally for its fertilizer value (3.50) and to help the cities (3.47) and then because of the environment (3.36).

This same type of analysis for place of residence shows that people who live on a farm would use sludge to help the cities (3.51) and then for its fertilizer value (3.16) and to help protect the environment (3.07). The non-farm rural population believes sludge should be used principally because of its fertilizer value (3.56). This group places an equal value on its use to help the cities and to protect the environment (3.36). The urban and suburban population place a high value on all three reasons given for the use of sludge: as a fertilizer (3.60), to protect the environment (3.52) and to help the cities (3.50). Thus, the analysis points out the irony that people who live on farms view land application to be primarily a means of helping the cities with their disposal problem while people who do not live on farms place a proportionally greater value on land application as a means of helping the farmers utilize the fertilizer and soil conditioning properties of sludge. There appears to be a need to make each group aware of the other's point of view in this regard.

The second group of attitudinal questions (Items 14-16) concerns reactions to actual spreading of sludge: on one's own land; on a neighbor's field; and, neighbors reaction to sludge spreading on one's own land. These reactions were analyzed in relation to most of the previous variables. Through the use of a Chi-Square Test of Significance it was found that property ownership, place of residence, occupation, and size of farm were <u>not</u> significantly related to these reactions to the landspreading of sludge. Age and source of sludge information were significantly related to personal sludge reactions. Also, sex, personal experience with sludge, choice of sludge definition, and the three primary reasons why sludge is used are all significantly related to reactions to the landspreading of sludge. An analysis of the relationship of age and reaction to sludge use on one's own land shows the following means:

13-25 = 3.9286

26-35 = 4.0826

36-50 = 4.0502

51-65 = 3.9622

65+ = 3.7807

Clearly the oldest age category stands out as the group most unfavorable to personal use of sludge. The comparison of age to a person's reaction to a

neighbor's use of sludge also shows the oldest age category as the most unfavorable. Here the means are as follows:

18-25 = 4.000
26-35 = 4.0791
36-50 = 4.1246
51-65 = 4.0146
65+ = 3.7611

A similar comparison can be made between reaction to one's own use of sludge and one's source of information on the land application of sewage sludge. The means for each group are as follows:

Attended meetings	= 4.0625
Read articles	= 4.1715
Both of the above	= 4.000
Have seen it in use	= 4.1316
Other	= 4.0577
No source of information	= 3.7633

Here the group of people who have no source of sludge information and, therefore, probably are the least informed, is the group that reacts most unfavorably to personal sludge usage. The comparison of source of sludge information to neighbor's usage of sludge shows much the same thing. The means for this comparison are as follows:

Attended meetings	= 4.1053
Read articles	= 4.2846
Both of the above	= 4.0196
Have seen it in use	= 4.2439
Other	= 4.0364
No source of information	= 3.7876

The analysis of reactions to sludge use by sex shows that females have a much more negative reaction to sludge use than do males. This is true whether it is their reaction to personal usage, reaction to neighbors' usage, or their perception of a neighbor's reaction to their personal usage. Table 7 shows a steady percentage decrease for females for each of the three types of reaction to land application. As shows in Table 7A, 61.1% of the people who would personally react very unfavorably to the use of sludge on their own land are female compared to only 38.5% of the very favorable reactions who are female. Tables 7B and 7C show a similar distribution of percentages for the female group. As can be seen in Table 7, males as a group react much more favorably to all three questions regarding sludge usage.

TABLE 7. SEX AND REACTION TO SLUDGE USAGE

A. How would you react to having sludge spread on your land?

	Numbers			Percent		
	Males	Females	Total	Males	Females	Total
Very unfavorably	61	96	157	38.9	61.1	100.0
Unfavorably	52	67	119	43.7	56.3	100.0
Undecided	183	154	337	54.4	45.7	100.0
Favorably	146	96	242	60.3	39.7	100.0
Very favorably	48	38	78	61.5	38.5	100.0
Total	490	443	933	52.5	47.5	100.0

B. How would you feel about sludge being spread on a neighbor's fields?

	Numbers			Percent		
	Males	Females	Total	Males	Females	Total
Very unfavorably	57	108	165	34.5	65.5	100.0
Unfavorably	55	72	127	43.3	56.7	100.0
Undecided	231	230	461	50.1	49.9	100.0
Favorably	192	137	329	58.4	41.6	100.0
Very favorably	41	24	65	63.1	36.9	100.0
Total	576	571	1147	50.2	49.8	100.0

C. How would neighbors react to sludge spreading on your land?

	Numbers			Percent		
	Males	Females	Total	Males	Females	Total
Very unfavorably	67	118	185	36.2	63.8	100.0
Unfavorably	94	98	192	49.0	51.0	100.0
Undecided	313	273	586	53.4	46.6	100.0
Favorably	46	29	75	61.3	38.7	100.0
Very favorably	13	2	15	86.7	13.3	100.0
Total	533	520	1053	50.6	49.4	100.0

The analysis of reactions to sludge by personal experience with sludge (See Table 8) shows that farmers who have used sludge would be favorably disposed to use it again or to continue to use it. They also have very favorable reactions to a neighbor using it and they also think that neighbors' reactions will be very favorable. On the other extreme, people who have not heard of it do not react favorably to sludge being spread on their land, nor do they react favorably to sludge being spread on a neighbor's land, nor do they think that neighbors would react favorably to their spreading sludge.

To analyze the reaction to sludge by choice of sludge definition, the correct definition (1. A product from municipal sewage treatment plants) was compared to all of the incorrect definitions. (See Table 9.) It was found that people who chose the correct definition have a more favorable reaction to sludge usage. This was especially true for personal usage, where the correct definition percentage progressively increases from 70.9% for very unfavorable to 93.5% for very favorable; and for personal reaction to neighbors' usage, where the correct definition percentage increases from 68.4% for very unfavorable to 92.3% for very favorable.

The analysis of reactions to sludge usage with the primary reasons sludge is used shows a positive relationship between these two sets of variables. Table 10 presents the means for each of the primary reasons for using sludge. Here it can be seen that people who don't think helping the cities is an important reason for using sludge also would be unfavorably disposed to using sludge, having their neighbors use sludge or think their neighbors' reaction to their sludge usage would be unfavorable. This same relationship holds true for both other primary reasons for using sludge: to take advantage of its fertilizer value and to help protect the environment.

The last attitudinal section of the questionnaire (Items 17-34) concerns specific statements about municipal sewage sludge. The responses to these 18 individual attitude questions were subjected to a factor analysis in order to identify the dimensions underlying the responses. The factor analysis disclosed five underlying factors:

Factor 1: Sludge is a good source of nitrogen fertilizer.

Factor 2: Chemical analysis of the sludge and land should be conducted prior to application.

Factor 3: Sludge has minimal impacts on water quality, odor, health or prevalence of insects.

Factor 4: Sludge has undesirable impacts in the areas of soil compaction, disease and insects, and has minimal usefulness as a soil conditioner.

Factor 5: Sludge should not be applied to land used for dairy pasture or on growing crops.

TABLE 8. PERSONAL EXPERIENCE WITH SLUDGE AND REACTIONS TOWARD ITS USE

How would you react to having sludge spread on your land?

	Numbers					Percent				
	Used it	Neighbors Used it	Heard of it	Not heard of it	Total	Used it	Neighbors used it	Heard of it	Not heard of it	Total
Very unfavorably	8	20	70	57	155	3.2	12.9	45.2	36.8	100.0
Unfavorably	1	20	61	37	119	.8	16.8	51.3	31.1	100.0
Undecided	7	33	203	89	332	2.1	9.9	61.1	26.8	100.0
Favorably	25	32	149	35	241	10.4	13.3	61.8	14.5	100.0
Very favorably	17	12	38	10	77	22.1	15.6	49.4	13.0	100.0
Total	58	117	521	228	924	6.3	12.7	56.4	24.7	100.0

How would you feel about sludge being spread on a neighbor's fields?

	Numbers					Percent				
	Used it	Neighbors used it	Heard of it	Not heard of it	Total	Used it	Neighbors used it	Heard of it	Not heard of it	Total
Very unfavorably	6	19	64	71	160	3.7	11.9	40.0	44.4	100.0
Unfavorably	0	21	62	44	127	0	16.5	48.8	34.6	100.0
Undecided	8	35	259	153	455	1.8	7.7	56.9	33.6	100.0
Favorably	29	46	204	50	329	8.8	14.0	62.0	15.2	100.0
Very favorably	16	10	33	5	64	25.0	15.6	51.6	7.8	100.0
Total	59	131	622	323	1135	5.2	11.5	54.8	28.5	100.0

How would neighbors react to sludge spreading on your land?

	Numbers					Percent				
	Used it	Neighbors used it	Heard of it	Not heard of it	Total	Used it	Neighbors used it	Heard of it	Not heard of it	Total
Very unfavorably	4	24	84	70	182	2.2	13.2	46.2	38.5	100.0
Unfavorably	7	22	104	58	191	3.7	11.5	54.5	30.4	100.0
Undecided	30	65	340	143	578	5.2	11.2	58.8	24.7	100.0
Favorably	10	12	40	13	75	13.3	16.0	53.3	17.3	100.0
Very favorably	3	3	9	0	15	20.0	20.0	60.0	0	100.0
Total	54	126	577	284	1041	5.2	12.1	55.4	27.3	100.0

TABLE 9. SLUDGE DEFINITION AND REACTIONS TO SLUDGE USAGE

How would you react to having sludge spread on your land?

	Numbers			Percent		
	Correct (1)	Incorrect (2-5)	Total	Correct (1)	Incorrect (2-5)	Total
Very unfavorably	107	44	151	70.9	29.1	100.0
Unfavorably	97	23	120	80.8	19.2	100.0
Undecided	282	50	332	84.9	15.1	100.0
Favorably	210	31	241	86.8	13.2	100.0
Very favorably	72	5	77	93.5	6.5	100.0
Total	768	154	922	83.3	16.7	100.0

How would you feel about sludge being spread on a neighbor's fields?

	Numbers			Percent		
	Correct (1)	Incorrect (2-5)	Total	Correct (1)	Incorrect (2-5)	Total
Very unfavorably	108	50	158	68.4	31.6	100.0
Unfavorably	101	26	127	79.5	20.5	100.0
Undecided	389	68	457	85.1	14.9	100.0
Favorably	289	41	330	87.6	12.4	100.0
Very favorably	60	5	65	92.3	7.7	100.0
Total	947	190	1137	83.3	16.7	100.0

How would neighbor react to sludge spreading on your land?

	Numbers			Percent		
	Correct (1)	Incorrect (2-5)	Total	Correct (1)	Incorrect (2-5)	Total
Very unfavorably	130	49	179	72.6	27.4	100.0
Unfavorably	158	35	193	81.9	18.1	100.0
Undecided	508	74	582	87.3	12.7	100.0
Favorably	60	14	74	81.0	19.0	100.0
Very favorably	15	0	15	100.0	0	100.0
Total	871	172	1043	83.5	16.5	100.0

TABLE 10. REACTIONS TO THE USE OF SLUDGE AND PRIMARY REASONS FOR SLUDGE USAGE

How would you react to having sludge spread on your land?

	Help the cities and sewage districts get rid of the sludge.	Take advantage of the fertilizer and soil conditioning value of the sludge.	Help protect the environment, since landspreading is a more environmentally acceptable means of disposal than other methods.
Not at all important	2.9733	2.6235	2.9919
Slightly important	3.5474	3.2331	3.5725
Moderately important	4.0541	3.8992	4.0296
Very important	4.2661	4.3810	4.3804
Of highest importance	4.0241	4.9067	4.5564
Total	3.9875	3.9966	4.0058

How would you feel about sludge being spread on a neighbor's fields?

	Help the cities and sewage districts get rid of the sludge.	Take advantage of the fertilizer and soil conditioning value of the sludge.	Help protect the environment, since landspreading is a more environmentally acceptable means of disposal than other methods.
Not at all important	2.9263	2.8476	3.1064
Slightly important	3.7339	3.4268	3.6848
Moderately important	4.1429	3.9826	4.1351
Very important	4.2591	4.3293	4.3373
Of highest importance	4.0712	4.7350	4.3911
Total	4.0239	4.0339	4.0362

(continued)

TABLE 10(continued)

How would neighbors react to sludge spreading on your land?

	Help the cities and sewage districts get rid of the sludge	Take advantage of the fertilizer and soil conditioning value of the sludge.	Help protect the environment, since landspreading is a more environmentally acceptable means of disposal than other methods.
Not at all important	2.9011	2.8586	2.9710
Slightly important	3.4825	3.1688	3.4051
Moderately important	3.6091	3.5730	3.6793
Very important	3.6827	3.7860	3.7584
Of highest importance	3.6611	4.0057	3.8089
Total	3.5686	3.5766	3.5810

* All of the values in this table are means. Mean score of 5-point reaction scale; 2=very unfavorable, 6=very favorable.

These five factors were analyzed by the various background characteristics of the respondents, through the use of an analysis of variance. It was found that experience with land application of sewage sludge and willingness to allow sludge usage were almost always significant in relation to the five factors (See Table 11A). Because of the high degree of significance with these two variables, a multiple classification analysis (MCA) was performed to determine the extent to which significance on the other variables might be due to their interrelatedness to these two variables (i.e., "experience with land application" and "willingness to allow one's land to be used for land application"). The results of this multiple classification analysis (MCA) are shown in Table 11B. In Table 11B it can be seen that many of the interactions that were found to be significant (Table 11A) can be explained because of the two variables concerning experience and willingness to use sludge. The four remaining significances indicate the following four trends. One, that people who live on a small farm--under 100 acres--more strongly agree with Factor 1 - "Sludge is a good source of nitrogen fertilizer," than do people who live on larger farms. The means, on a 5 point scale, 1=strongly disagree, 5=strongly agree, are:

Less than 100 acres = 3.3810
101-300 acres = 3.1654
Over 300 acres = 3.1672

Two, that property owners agree to a greater degree with Factor 3 - "Sludge has minimal impacts on water quality, odor, health or prevalance of insects." than do tenants. The means are:

Property owners = 2.8626
Tenants = 2.6254

Three, that people over 65 and, four, that farmers each agree with Factor 4 - "Sludge has undesirable impacts in the areas of soil compaction, disease and insects and has minimal usefulness as a soil conditioner," the means for age are:

65+ = 3.1201
51-65 = 2.9941
36-50 = 2.8513
26-35 = 2.9511
18-25 = 2.9375

the means for occupation are:

Farmers = 3.0815
Non-farmers = 2.9246

As stated previously, willingness to allow sludge usage was consistently significant in relation to all 5 factors. And, experience with the land

TABLE 11. BACKGROUND CHARACTERISTICS AS RELATED TO THE FACTORS OF SPECIFIC ATTITUDES TOWARD SLUDGE USAGE

	A Factors					B Factors (MCA)				
	1	2	3	4	5	1	2	3	4	5
Age	.698	.060	.185	.001*	.002*	.401	.180	.496	.018*	.618
Sex	.398	.266	.000*	.002*	.028*	.924	.380	.026*	.907	.915
Are you a property owner or tenant?	.488	.225	.019*	.333	.114	.590	.149	.081	.999	.174
Place of residence	.048*	.276	.288	.054	.138	.253	.726	.887	.134	.935
My principal occupation is farming	.108	.239	.297	.001*	.005*	.652	.388	.383	.040*	.093
Total number of acres owned or farmed	.002*	.800	.292	.743	.673	.001*	.947	.126	.686	.893
Experience with land application of sewage sludge	.131	.003*	.000*	.000*	.024*	NOT APPLICABLE				
Would you allow your land to be used for landspreading of sludge?	0*	.000*	0*	0*	0*	NOT APPLICABLE				

* Significant using an analysis of variance test of significance

application of sewage sludge was related to all but one of the factors. These relationships are presented in Table 12. Specifically, one can see that people who would allow sludge to be spread on their land: (1) believe that sludge is a good source of nitrogen fertilizer; (2) do not feel as great a need as unwilling people that chemical analysis of the sludge and land should be conducted prior to application; (3) believe that sludge has minimal impacts on water quality, odor, health or prevalence of insects; (4) do not believe that sludge has undesirable impacts in the areas of soil compaction, disease and insects and has minimal usefulness as a soil conditioner; and, (5) believe that sludge should not be applied to land used for dairy pasture or on growing crops. Similarly, people who have had sludge spread on their land hold similar views, except that their belief that sludge should not be applied to land used for dairy pasture or on growing crops is not as strong as that of groups with less experience.

Knowledge and Interest--

Sewage sludge knowledge, both current and interest in the subject (Items 35-75), was analyzed in relation to place of residence. For the total sample, each of the 41 knowledge questions were analyzed in terms of means for both current knowledge and interest in the specific subject area. The difference of these means was analyzed by place of residence (i.e., the three subsamples): farm, non-farm rural, and urban/suburban.

In general, people who live on a farm start out with the greatest knowledge, followed by the non-farm rural group, and then the urban/suburban group. The farm group, in addition to starting out with the greatest knowledge, also has the greatest interest level. (This is not surprising since these are the people who are going to have to decide whether or not they want to use municipal sewage sludge.) The difference in the means also tends to be greatest among the farm group. These means and differences between means are provided in Table 13.

As shown in Table 13, questions 35 and 36 (i.e., landscape characteristics to consider in landspreading sludge; and physical properties of the soil to consider in landspreading) have the greatest current knowledge, namely, a mean of 2.0 out of a maximum 5.0. However, on these two questions, the interest in knowing (2.9) is not much greater than the current knowledge. Interest in knowing for these two items is among the lowest for all the items.

Questions 57 and 58 (i.e., presence of disease causing bacteria in sewage sludge and threat to human health; and, presence of heavy metals in sludge and dangers to crops, animal, and human health) are the areas where people (i.e., the total sample) have the greatest interest in knowing, namely, a mean of 3.5. The latter question on heavy metals also exhibits the greatest difference between the current knowledge and the interest in knowing means; namely a difference of 2.0. This is true because the current knowledge mean is 1.5 and the interest in knowing mean is 3.5. This large difference between current knowledge and interest in knowing with respect to the heavy metals question is consistent for each of the three place of residence subgroups.

TABLE 12. MEAN* SCORES OF WILLINGNESS TO ALLOW SLUDGE USAGE AND EXPERIENCE WITH SLUDGE BY THE 5 FACTORS

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
A. Would you allow your land to be used for land-spreading of sludge?					
No	3.0844	3.9610	2.3870	3.2434	3.0442
Yes	3.4024	3.7082	3.1467	2.7026	2.5551
B. Experience with land application of sewage sludge					
Sludge has been spread on my land	N.S.	3.6209	3.1537	2.6715	2.6375
Sludge has been spread on a neighbor's land or in the community	N.S.	3.8505	2.7964	3.0214	2.8917
Have heard of the land application of sludge	N.S.	3.8850	2.8245	2.9174	2.7499
Have not heard of the land application of sludge	N.S.	3.7097	2.5352	3.0808	2.8396

* Mean score of a 5-point agreement scale, 1 = strongly disagree, 5 = strongly agree.

TABLE 13. SEWAGE SLUDGE KNOWLEDGE AND INTEREST IN KNOWING

	Means		Difference between means			
	Current Knowledge	Interest in knowing	Farm	Non-farm rural	Urban and suburban	Total
Landscape characteristics to consider in land-spreading sludge (slope, water sources, public roads).	2.0	2.9	.8	.9	.9	.9
Physical properties of the soil to consider in landspreading (soil types, drainage).	2.0	2.9	.9	.9	1.0	.9
Restrictions on the application of sludge near water sources (bodies of water and ground water).	1.9	3.2	1.1	1.3	1.4	1.2
Recommended times of sludge application: season and weather conditions.	1.9	3.0	1.0	1.1	1.2	1.1
Precautions in the application of sludge on grain and fruit crops.	1.7	3.1	1.4	1.2	1.4	1.4
Restrictions to the application of sludge on leafy and root crops.	1.6	3.0	1.4	1.3	1.4	1.4
Precautions in the application of sludge to pasture land.	1.7	3.0	1.3	1.2	1.3	1.3
Restrictions to the application of sludge on dairy farm land.	1.7	2.9	1.2	1.2	1.4	1.2
Degree to which sludge varies in composition and fertilizer value.	1.7	3.1	1.5	1.2	1.3	1.4
Supplementation of sludge with commercial inorganic fertilizers.	1.6	3.1	1.6	1.2	1.3	1.4
Comparisons of crop yields between sludge and commercial fertilizer.	1.6	3.1	1.6	1.3	1.4	1.5
Soil conditioning properties of sewage sludge.	1.7	3.1	1.5	1.3	1.3	1.4
Use of sludge in reclaiming lands depleted of organic matter, such as stripmined land.	1.6	2.9	1.1	1.3	1.4	1.3

(continued)

TABLE 13 (continued)

	Means		Difference between means			
	Current knowledge	Interest in knowing	Farm	Non-farm rural	Urban and suburban	Total
Nitrogen, phosphorus, and potassium content of sludge.	1.6	3.1	1.6	1.4	1.3	1.5
Comparative availability and use of dry and liquid sludge.	1.5	2.9	1.5	1.3	1.3	1.4
Application rates as determined by soil needs and quantity of sludge that can be safely spread	1.5	3.0	1.6	1.4	1.4	1.5
Soil testing and commercial fertilizer required on sludge ammended soils.	1.5	3.0	1.6	1.4	1.3	1.5
Preapplication testing of adjacent water sources for nitrates and coliform bacteria.	1.4	3.0	1.7	1.6	1.5	1.6
Testing of sludge to determine nutrient, metal, and soluble salts content.	1.4	3.1	1.8	1.6	1.4	1.6
Responsibilities of the municipality in providing landowners with results of sludge analysis.	1.5	3.3	1.9	1.7	1.7	1.8
Monitoring of crop yields and the amount of heavy metals absorbed by crops.	1.4	3.2	1.9	1.6	1.7	1.7
Monitoring of water sources for trace elements (zinc, lead, mercury, etc.) and nitrates.	1.4	3.3	1.9	1.7	1.8	1.8
Presence of disease causing bacteria in sewage sludge and threat to human health.	1.6	3.5	2.0	1.8	1.9	1.9
Presence of heavy metals in sludge and dangers to crops, animal, and human health.	1.5	3.5	1.0	2.0	2.0	2.0

(continued)

TABLE 13 (continued)

	Means		Difference between means			
	Current knowledge	Interest in knowing	Farm	Non-farm rural	Urban and suburban	Total
Threats to wildlife of sludge application on forest and recreational areas.	1.5	3.3	1.8	1.9	2.0	1.9
Odor and insect nuisance considerations in landspreading sludge.	1.8	3.4	1.6	1.6	1.7	1.6
Sludge application techniques	1.7	3.0	1.3	1.3	1.2	1.3
Machinery required to transport and apply sludge.	1.8	2.9	1.2	1.0	1.1	1.1
Comparison of sludge application by surface spreading to application by soil injection.	1.5	2.9	1.6	1.3	1.3	1.4
Recommended hygiene practices during land-spreading.	1.5	3.1	1.8	1.6	1.5	1.7
Means of preventing soil compaction caused by machinery.	1.7	2.9	1.3	1.2	1.1	1.2
Economical advantages to landowners of sludge use.	1.7	3.2	1.6	1.4	1.4	1.5
Availability of sludge in Ohio's counties.	1.6	2.9	1.4	1.3	1.3	1.4
Sources and requirements for obtaining sludge in Ohio's counties.	1.5	2.9	1.6	1.3	1.3	1.4
Responsibilities and legal liabilities of the landowner in landspreading sludge.	1.4	3.2	2.0	1.8	1.7	1.8
Role of the Ohio Environmental Protection Agency and local health departments.	1.5	3.2	1.8	1.7	1.7	1.7
Value of a written contract between landowner and municipality.	1.5	3.1	1.9	1.5	1.5	1.7

(continued)

TABLE 13 (continued)

	Means		Difference between means			
	Current knowledge	Interest in knowing	Farm	Non-farm rural	Urban and suburban	Total
Sewage sludge treatment processes.	1.6	3.1	1.6	1.4	1.4	1.5
Sludge treatment for the destruction of disease causing bacteria	1.5	3.3	1.9	1.7	1.7	1.8
Ohio counties which have done landspreading	1.5	3.1	1.7	1.6	1.5	1.6
Acreage in Ohio needed for municipal sewage sludge disposal.	1.3	3.0	1.8	1.6	1.6	1.7

A large difference between the two means (i.e., 2.0) also exists for the farm group for questions 57 and 69 (i.e., presence of disease causing bacteria in sewage sludge and threat to human health; and responsibilities and legal liabilities of the land owner in landspreading sludge). This large difference between the knowledge and interest means also exists for the urban/suburban group for question 59 (i.e., threats to wildlife of sludge application on forest and recreational areas).

The range of the differences between means presented in Table 13 is from 0.8 to 2.0. Any difference in the means which is greater than 1.5 should probably be considered an important area for education.

Survey Conclusions--

In conclusion, the questionnaire that was sent to Ohio residents to measure their attitudes toward the land application of municipal sewage sludge found, in general, that the more people know about sludge, the less they restrict its usage. The group within the general population that knows the most about municipal sewage sludge are the farmers that have used it. An educational program in which these sludge users discuss the topic with their fellow farmers might be an optimum approach in changing the attitudes of individuals who currently have negative feelings about sludge. It also might be beneficial to find out from those people who have used sludge the advantages of municipal sewage sludge usage. These advantages could then be used as a basis for other information programs. The Ohio Farm Bureau's "Sludge Demonstration" project may demonstrate such "advantages."

It was also found through the survey that women in general know less about sludge than do men, and therefore have more negative feelings about its usage. Thus, an effective educational program aimed at women would probably be essential to insure community acceptance of land application. The education of women regarding land application could be of great importance within the farm community. (It is impossible to say how many male farmers would not allow the usage of municipal sewage sludge, because their wives, who may know very little about the subject, are opposed to land application.)

As stated previously, the survey demonstrated that the more people know about sludge, the more they are willing to use it and/or accept land application in the community. Therefore, it appears reasonable that the continual dissemination of accurate and balanced information on this topic can only have positive effects.

Consideration was given to integration of the results of the survey with those of other surveys of attitudes toward the land application of sewage sludge. However, such integration, with the two other surveys which were identified, did not appear to be meaningful because of differences in response categories and because the other surveys were based on extremely small samples.

EDUCATIONAL PROGRAM

The educational program was developed and implemented through the following steps:

- Development of the educational program materials
- Development of pre-/post- meeting evaluation instruments
- Implementation of the educational meetings.

Each of these steps is discussed in the following pages. Also referenced are the field trips which were dependent on implementation of the sludge demonstration project.

Development of the Educational Program Materials

The educational program was developed on the basis of a preliminary analysis of the survey data in the area of current knowledge and interest in knowing. A draft outline of the educational program was developed utilizing the survey information. This draft outline, together with the preliminary analysis of survey results, was provided to subject matter experts[1] in the Ohio State University's Department of Agronomy and Department of Agricultural Engineering. These subject matter experts developed a detailed content outline for a series of 35mm slides to be used during the educational presentation. The content of the slide presentation consisted of "text" slides and "photographs." The "text" slides were produced by Battelle. A color format was used. The "photograph" slides were provided by the subject matter experts.[2] Battelle produced three complete sets of the slide program. Two sets of the slide program were provided to the two Ohio State University subject matter experts for use in their presentation at the farm and non-farm rural group meetings. One copy of the slide program was retained by the Ohio Farm Bureau Federation for use at the urban/suburban group meetings and for our project files.

Development of the Pre-/Post-Meeting Evaluation Instruments

The pre-/post- meeting evaluation instruments were designed to be filled out in a short amount of time in order to conserve meeting time for the educational program and to maintain attendee motivation. Basically, a subset of items were selected from the survey questionnaire in the areas of background information and attitudes. In some instances the format of the items was changed. Two forms of the pre-/post- meeting evaluation instrument were developed. Form 1 was tailored primarily for a farm population. Form 2 was tailored for a non-farm or urban population.

Educational Meetings

Two series of educational meetings were held. The first series was

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[1]These two subject matter experts gave the educational presentations directed toward the farm group.

[2]Slides which were part of existing sludge education programs, principally the educational program utilized by the City of Defiance, Ohio, Water Pollution Control Department, were provided to the subject matter experts for their review.

directed primarily toward the farm population, although non-farm rural and urban/suburban participants were not excluded. A meeting was held for the farm population in each of the eight Ohio counties which were surveyed. Locations and dates for the first series of educational meetings were:

Jackson County - March 30, 1978

Montgomery County - April 5, 1978

Pickaway County - April 6, 1978

Greene County - April 11, 1978

Defiance County - April 12, 1978

Medina County - April 13, 1978

Franklin County - April 19, 1978

Muskingum County - April 20, 1978

The meetings were scheduled in the evening, from 8:00 p.m. to approximately 9:30 p.m. for the convenience of the public. All meetings were held on Tuesdays, Wednesdays, or Thursdays, and during a time of year when it was expected that farmers would find it convenient to attend. Information obtained from local extension agents confirmed that seasonal farm work was not a problem with attendance, particularly in view of the extensive amount of rain during this period. The meetings were arranged by the local agricultural extension agent and/or Ohio Farm Bureau organization director at centrally located public places, in order to encourage attendance.

Publicity for the meetings included personal contacts by the extension agents and OFB organization directors, news paper notices, radio notices, newspaper ads, and a variety of newsletters. Door prizes were offered as a token incentive to attend, and so that registration cards for the prizes could be used as an attendance list for mailing the post-meeting evaluation instrument. Attendance at the meetings ranged from a low of 8 participants in Medina County to a high of 35 in Franklin County. Participants were mostly farmers but did include some non-farm interested citizens.

Participants were asked to fill out the pre-meeting evaluation instrument prior to the start of the meeting. The meetings began normally at about 8:15 p.m. with a description of the purpose of the program and introduction of the speakers. Either Dr. Richard White or Dr. Robert Miller[1], both of Ohio State University presented the educational slide program which took about 45 minutes, after which the meeting was opened for questions until adjournment. In general, a large number of questions were asked.

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[1]Dr. Richard White is an associate professor and extension agricultural engineer, The Ohio State University, Department of Agricultural Engineering. Dr. Robert Miller is a professor, The Ohio State University, Department of Agronomy.

The meetings were formally adjourned at 9:30 p.m., but response to additional questions usually continued to 10:00-10:30 p.m.

The second series of educational meetings were directed primarily toward the urban/suburban population, although the farm and non-farm rural population were not excluded. Because of concern about attendance of the urban/suburban population at an advertised meeting, it was decided to reach this population group through educational meetings presented as part of a civic club or organization's regularly scheduled meeting. Civic clubs which participated were: Lions International, Rotary Internationl, Ruritan National, Sertoma International, and the Upper Arlington Extension Homemakers Club.

A meeting was held for a civic club in six of the Ohio counties which were surveyed. Meetings for the urban/suburban group could not be scheduled for Muskingum and Montgomery Counties. However, a substitute was found for Muskingum County (i.e., Belmont County). Locations and dates for the second series of educational meetings were:

Jackson County - May 3, 1978

Belmont County - May 16, 1978

Franklin County - May 18, 1978

Medina County - May 22, 1978

Defiance County - May 25, 1978

Greene County - May 31, 1978

Pickaway County - June 1, 1978

Some of these meetings were held in the evening, following dinner and some of the meetings were held in the early afternoon, following lunch. Attendance at the meetings ranged from a low of 21 to a high of 74. Participants were mostly non-farmers from urban, suburban or non-farm rural areas, although some farmers were in attendance.

Participants were asked to fill out the pre-meeting evaluation instrument prior to the start of the educational presentation. The educational slide presentation was tailored to the available time (35-45 minutes) and was presented by Mr. Ned Musselman of the Ohio Farm Bureau Federation and Mr. Lawrence Welling of Battelle-Columbus. Following the presentation, the meeting was opened for questions. The extent of questioning was dependent upon available time. With respect to the meetings in Jackson County and Belmont County, names and addresses of attendees were obtained for purposes of mailing the post-meeting evaluation instrument. The post-meeting evaluation instrument was administered immediately following the educational presentation at the other meetings.

Field Trips

As originally planned, field trips to demonstration sites in the four Ohio counties participating in the demonstration project were to be conducted by Farm Bureau personnel. Due to delays in obtaining funding for the demonstration project, the Farm Bureau was not able to implement the demonstration project as early as scheduled. Consequently, an evaluation of such field trips was not possible as part of this study on the effectiveness of land application education methods.

EFFECTIVENESS OF THE EDUCATIONAL PROGRAM

The effectiveness of the educational program was determined through the following two steps:

- Adminstration of the pre-/post- meeting evaluation instruments.
- Analysis of educational program effectiveness data.

Both of these steps are described in the following pages.

Administration of the Pre-/Post- Meeting Evaluation Instruments

A slightly different methodology for the two series of educational meetings was followed in the adminstration of the pre-/post- meeting evaluation instruments. Two somewhat different forms of meeting evaluation instruments were used for the two series of educational meetings. Form I was used for the first series of meetings. Form II was used for the second series of meetings. No personal identification information was collected on the evaluation instruments in order to preserve anonymity.

Educational Meeting-Series Number 1--

For the first series of educational meetings (i.e., those directed primarily toward the farm population) the pre-meeting evaluation instrument (Form I) was administered and collected immediately prior to the educational presentation. At the same time, attendees were asked to fill out a name and address card. This name and address card was used for the selection of door prize winners (an attendance incentive) and also to mail out the post-meeting evaluation instrument. The post-meeting evaluation instrument (Form I) was mailed approximately two weeks after the date of the meeting.

Generally, most attendees filled out the pre-meeting instrument. As shown in Table 14A, the total response rate of post-meeting instruments was 54.5%. Medina County had the highest response rate (100.00%) and Greene County had the lowest response rate (33.3%).

Educational Meeting-Series Number 2--

For the second series of educational meetings (i.e., those directed primarily toward the non-farm, urban/suburban population) the pre-meeting evaluation instrument (Form II) was administered and collected immediately

TABLE 14. EVALUATIVE RESPONSE RATE OF EDUCATIONAL MEETINGS

County	A Form 1 Pre	A Form 1 Post(*)	A Form 1 %	B Form 2 Pre	B Form 2 Post	B Form 2 %
Medina (A)	4	4	100.0	54	45	83.1
Defiance (D)	15	7	46.7	22	22	100.0
Franklin (F)	30	18	60.0	21	18	85.7
Greene (G)	9	3	33.3	29	18	62.1
Jackson (J)	7	5	71.4	24	7*	29.2
Muskingum (K)	18	9	50.0	-	-	-
Montgomery (M)	7	3	42.9	-	-	-
Pickaway (P)	22	12	54.5	62	51	82.3
Belmont (B)	-	-	-	29	11*	37.9
Total	112	61	54.5	241	172	71.4

(*) Post test mailed.

Questionnaires that were handed back blank were not counted. There were also people who did not fill out a pre-meeting questionnaire, but whose name and address were obtained. These individuals may have returned the post-meeting questionnaire. This may result in a slight variance in the percentage of responses.

prior to the educational presentation. For two of the counties, namely Jackson County and Belmont County, meeting attendees were also asked to fill out a name and address card. For these two counties, the post-meeting instrument (Form II) was identical to the pre-meeting instrument (Form II) and was mailed approximately two weeks after the date of the meeting. For the other five Series 2 educational meetings, the pre-meeting evaluation instrument (Form II) was administered and collected immediately prior to the educational presentation, and the post-meeting instrument (Form II) was administered and collected immediately following the meeting or question and answer period.

As shown in Table 14B, the total response rate of post-meeting instruments was 71.4%. Defiance County had the highest response rate (100.0%) and Jackson County had the lowest response rate (29.2%). However, it must be remembered that post-meeting instruments for the Jackson meeting were sent and returned by mail.

Analysis of Educational Program Effectiveness

The effectiveness of the educational program was determined by an analysis of the responses on the pre- and post- meeting evaluation instruments. This analysis is discussed separately in the following pages for the first series of educational meetings (Form I evaluation instrument) and for the second series of educational meetings (Form II evaluation instrument).

Form I--

Form I was designed to be filled out by a farm population. The 27 questions can be divided into background information and attitudes. The background information for both the pre- and post- meeting instruments are presented because the return rate of the post-meeting instrument is only 54% of the pre-test. This information is presented in Table 15. As shown in Table 15, the targeted population was reached via the first series of meetings. The pre-test results show that 65.2% live on a farm and 75.0% are at least part-time farmers. For the post-test, an almost identical 65.6% live on a farm and 76.4% are at least part-time farmers. Prior to the particular meeting in the respective counties, only 18.0% of the attendees had previously attended a meeting on sludge. Among the people who attended the educational meetings, 8.4% had used sludge themselves (this compares with 4.7% of the surveyed Ohio population). In addition: 8.4% of the attendees had seen it in use; 54.2% had read articles on the subject or attended educational meetings; and 24.3% had no specific source of information on sludge. When this group was asked if they would be willing to use sludge, 42.9% of the pre-test indicated they would, compared to 47.5% of the post-test. While there is an increase in willingness to use sludge, it is not significant.

Also not significant were the differences in attitudes in the questions related to use of sludge, both personal use and a neighbor's use. (See Table 16.) There were significant results on 13 of the 18 specific attitudinal questions. In all but one case the mean increased, which means the respondents' attitudes were more favorable. (These significances were for questions 10, 11, 14, 15, 16, 18, 19, 21, 22, 23, 26 and 27.) The

TABLE 15. BACKGROUND VARIABLES ON FORM 1 (FARM POPULATION)

	Pre-test		Post-test	
	No.	%	No.	%
1. Place of residence				
Farm	73	65.1	40	65.6
Non-farm, rural	14	12.5	5	8.2
Urban or suburban	25	22.3	16	26.2
Total	112	100.0	61	100.0
2. Principal occupation is farming				
No	61	54.5	36	59.0
Yes	51	45.5	25	41.0
Total	112	100.0	61	100.0
3. Part-time farmer				
No	28	25.0	15	24.6
Yes	36	32.1	23	37.7
Full-time farmer	48	42.9	23	37.7
Total	112	100.0	61	100.0
4. Would you allow your land to be used for the landspreading of sludge?				
No	16	14.3	13	21.3
Yes	48	42.9	29	47.5
Don't know	19	17.0	6	9.8
Do not live on a farm	29	25.9	13	21.3
Total	112	100.0	61	100.0
5. Attended meeting on sludge disposal				
No	91	82.0		
Yes	20	18.0		
Total	111	100.0		
6. Source of information regarding land application of municipal sewage sludge				
Have attended educational meetings or programs on the land application of sewage sludge	12	11.2		
Have read articles or brochures on the land application of sewage sludge	32	29.9		
Farm Bureau meetings	14	13.1		
Have used it myself	8	7.5		
Have seen it in use	9	8.4		
Other	6	5.6		
No source of information	107	100.0		

(continued)

TABLE 15 (continued)

	Pre-test		Post-test	
	No.	%	No.	%
7. Definition of sewage sludge				
A product from municipal sewage treatment plants	91	87.5	56	91.8
Septic tank pumpings	1	1.0	0	0
Raw, untreated sewage	0	0	1	1.6
Any animal waste materials	1	1.0	0	0
More than one of the above	9	8.7	4	6.6
Other	2	1.9	0	0
Total	104	100.0	61	100.0

TABLE 16. ATTITUDINAL VARIABLES FOR FORM 1 (FARM POPULATION)

	Means		T-value
	Pre-test	Post-test	2-Tail prob
How would you react to having sludge spread on your land?	4.368	4.372*	.979
How would you feel about sludge being spread on a neighbor's fields?	4.427	4.527*	.519
It is important for the farm community to use sludge to help the cities and the sewage districts.	3.275	3.639**	.019+
The use of sludge on farm land will help protect the environment, since land spreading is a more environmentally acceptable means of disposal than other methods.	3.477	3.787**	.027+
The only reason farmers should use sludge is to take advantage of its fertilizer and soil conditioning value.	3.464	3.180**	.106
Significant soil compaction will occur during sludge spreading no matter what equipment or methods are used.	2.682	2.443**	.086
There is little chance that sewage sludge can spread human disease.	3.315	3.623**	.017+
Sewage sludge is a good source of nitrogen fertilizer.	3.179	3.770**	.000+
A farmer needs a legal contract to protect his rights and liability any time he allows sludge to be spread on his land.	3.477	3.836**	.016+
The amount of sludge which would have to be applied before any changes occur in soil structure is so great that the usefulness of sludge as a soil conditioner is minimal.	2.891	2.966**	.600
There is a minimal, organic odor present when sludge is first applied that quickly disappears as the sludge dries out.	3.414	3.867**	.000+
Applying sewage sludge to pasture land is likely to contribute to the spread of disease among livestock.	2.746	3.050**	.050+

(continued)

TABLE 16 (continued)

	Means		T-value
	Pre-test	Post-test	2-Tail prob
Almost all of Ohio's crop and pasture land is appropriate for land application of sludge.	3.982	3.082**	.528
If properly applied, there is little chance of runoff of sewage sludge into ponds and streams during or after application.	3.405	3.951**	.000+
Sewage sludge provides a source of nitrogen which is significantly cheaper than commercial fertilizers.	3.351	3.787**	.000+
Sludge should not be applied to dairy farm pasture land.	3.297	3.983**	.000+
Heavy metals (e.g., zinc, lead, cadmium, copper, mercury, etc.) in sewage sludge always have detrimental effects on soil productivity.	3.000	2.885**	.417
Landspreading of sewage sludge produces serious insect problems.	2.764	2.262**	.000+
A complete chemical analysis of sludge should be conducted prior to land application.	3.982	4.361**	.000+
A complete soil analysis should be performed prior to sludge application.	3.882	4.180**	.021+

* These questions use a 5-point favorability scale; 2 = very unfavorable, 6 = very favorable.

**These questions use a 5-point agreement scale; 1 = strongly disagree, 5 = strongly agree.

+ Significant

remaining question, 25, was worded negatively: "Landspreading of sewage sludge produces an insect problem," so the decreased change in the mean from 2.764 in the pre-test to 2.262 in the post-test was desirable.

Form II--

Form II was designed to be filled out by a non-farm population. The 15 questions can be divided into background information and attitudes. The background information for both the pre- and post- tests are presented because the rate of return of the post-test is only 71% of the pre-test. This information is presented in Table 17. As shown in Table 17, the targeted population was reached via the second series of meetings. In the pre-test 87.1% do not live on a farm and 80.9% do not farm. Similarly, in the post-test, 86.0% do not live on a farm and 80.1% do not farm. Prior to these meetings only 9.2% of the attendees had specific information on municipal sewage sludge. This would account for the 38.0% who, prior to the meeting, indicate that they "don't know" the most environmentally and economically sound means of sewage sludge disposal. An additional 23.6% indicated an approach other than land application as the most environmentally and economically sound means of sludge disposal. This compares with 9.4% who "don't know" and 7.0% who indicate a method other than land application, after listening to the educational presentation. These results, which are significant, at a .0000 level using a Chi-Square Test of Significance indicate that the advantages and benefits of land application were successfully transmitted during the meetings. Also significant at the .0000 level was the knowledge of what sewage sludge is. Prior to the meeting 70.5% knew the correct definition, compared to 91.7% after the meeting.

In addition, there was a significant change in this group's attitude toward both a neighbor or anyone in the community spreading sludge on their land. On this item, the mean increased from 3.089 to 3.564 for a neighbor's land and from 3.278 to 3.768 for land in the community. A larger mean indicates a more favorable response (See Table 18). There were significant results on 7 of the 8 specific attitudinal questions. These significances were for all but question 14 (i.e., the sewer sludge of most major cities should not be used for land application because of detrimental levels of heavy metals). For all but one of these 7 items for which significant results were obtained, the mean increased, which means the respondents' attitudes were more favorable. The remaining question, 15, was a negatively worded question: "Landspreading of sewage sludge produces serious insect problems," therefore the decreased change in the mean form 2.756 in the pre-test to 2.452 in the post-test was desirable.

The impression that is left after the comparisons between pre- and post- results of both groups is that a greater amount of attitudinal change had taken place in the group that was principally non-farm directed (Form II) than in the group that was principally farm directed (Form I). In Table 19 it can be seen that this impression is basically not true and that the impression is created because of the differing lengths of the two different pre-/post- meeting evaluation instruments. (In Form I, 13 of 20 attitude questions changed significantly; while in Form II, 9 out of 10 attitude questions changed significantly.) Table 19, which presents items which were

TABLE 17. BACKGROUND VARIABLES ON FORM 2 (NON-FARM POPULATION)

	Pre-test		Post-test	
	No.	%	No.	%
Place of residence				
Farm	31	12.9	24	14.0
Non-farm rural	39	16.2	28	16.4
Urban or suburban	171	71.0	119	69.6
Total	241	100.0	171	100.0
Relationship to farming				
Full-time farmer	14	5.8	11	6.4
Part-time farmer	32	13.3	23	13.5
Non-farmer	195	80.9	137	80.1
Total	241	100.0	171	100.0
Experience with land application of municipal sewage sludge				
Specific information	22	9.2		
Heard of it, no specific information	167	69.6		
Have not heard of it	51	21.2		
Total	240	100.0		
The most environmentally and economically sound means of sewage sludge disposal is:				
Ocean dumping	1	.4	1	.6
Incineration	7	3.0	3	1.8
Applying to farm land	91	38.4	143	83.6
Placing in lagoons	5	2.1	0	0
Drying and land fill	37	15.6	8	4.7
Other	6	2.5	0	0
Don't know	90	38.0	16	9.4
Total	237	100.0	171	100.0
Definition of sewage sludge				
A product from municipal sewage treatment plants	170	70.5	155	91.7
Septic tank pumpings	10	4.1	3	1.8
Raw, untreated sewage	26	10.8	5	3.0
Any animal waste materials	3	1.2	2	1.2
More than one of the above	13	5.4	1	.6
Other	1	.4	1	.6
Don't know	18	7.5	2	1.2
Total	241	100.0	169	100.0

TABLE 18. ATTITUDINAL VARIABLES FOR FORM 2 (NON-FARM POPULATION)

	Means		T value
	Pre-test	Post-test	2-Tail prob
How would you feel about sludge being spread on a neighbor's fields?	3.089	3.564*	.009+
How would you feel about sludge being spread on farm land in your community?	3.279	3.768*	.000+
It is important for the farm community to use sludge to help the cities and the sewage districts.	3.221	3.889**	.000+
The use of sludge on farm land will help protect the environment, since land spreading is a more environmentally acceptable means of disposal than other methods.	3.336	3.904**	.000+
There is little chance that sewage sludge can spread human disease.	3.172	3.610**	.000+
There is a minimal, organic odor present when sludge is first applied that quickly disappears as the sludge dries out.	3.395	3.800**	.000+
If properly applied, there is little chance of runoff of sewage sludge into ponds and streams during or after application.	3.263	3.839**	.000+
Sludge should not be applied to dairy farm pasture land.	3.210	4.018**	.000+
The sewage sludge of most major cities should not be used for land application because of detrimental levels of heavy metals.	2.939	2.894**	.597
Landspreading of sewage sludge produces serious insect problems.	2.756	2.452**	.000+

* These questions use a 5-point favorability scale; 1 = very unfavorable, 5 = very favorable.

** These questions use a 5-point agreement scale; 1 = strongly disagree, 5 = strongly agree.

\+ Significant

TABLE 19. COMPARISON OF IDENTICAL ITEMS FOR THE TWO EDUCATIONAL GROUPS

Question Number		Question	Means*				Analysis of variance significance of F 2-way interaction
			Form 1 (Farm)		Form 2 (Non-farm)		
Form 1	Form 2		Pre-test	Post-test	Pre-test	Post-test	
19	7	It is important for the farm community to use sludge to help the cities and the sewage districts.	3.275	3.639	3.221	3.889	.049
11	8	The use of sludge on farm land will help protect the environment, since landspreading is a more environmentally acceptable means of disposal than other methods.	3.477	3.787	3.336	3.904	.035
14	10	There is little chance that sewage sludge can spread human disease.	3.315	3.623	3.172	3.610	.373
18	11	There is a minimal, organic odor present when sludge is first applied that quickly disappears as the sludge dries out.	3.414	3.867	3.395	3.800	.695
21	12	If properly applied, there is little chance of runoff of sewage sludge into ponds and streams during or after application.	3.405	3.951	3.263	3.839	.655
23	13	Sludge should not be applied to dairy farm pasture land.	3.297	3.983	3.210	4.018	.313
25	15	Landspreading of sewage sludge produces serious insect problems.	2.764	2.262	2.756	2.452	.190

* Mean score of 5-point agreement scale. 1 = strongly disagree, 5 = strongly agree. All mean differences within groups are significant; for the level of significance, see Table 16 for Form 1 and Table 18 for Form 2.

included in both Form I and in Form II[1], demonstrates that there are only two cases where the differences within Form I are significantly different than the differences within Form II. The first of these two significant results is for the question pertaining to the farm community using sludge to help the cities, F=.049. Here, the two groups started out with similar attitudes, but there was a greater amount of positive attitudinal change for the non-farm group. The second significant result pertains to the question on the use of sludge on farm land to help protect the environment, F=.035. Here the farm group started out with more agreement on this question and the non-farm group ended up with more agreement on this question. For the remaining items, the degree of change on the pre-/post- test (Form I) for the farm group was not significantly different from the degree of change on the pre-/post- test (Form II) for the non-farm group.

In summary, the analysis of the educational programs indicates that this approach can be considered a successful means of conveying information about the land application of municipal sewage sludge.

[1] The differences within groups were significant for all of these items.

SECTION 4

SUMMARY OF RESULTS

- For people who live on a farm, willingness to use sludge is not related to age, farming as a principal occupation, or size of farm.

- Males who live on a farm are much more willing to use sludge on their own farmland than are females who live on a farm.

- Farm residents who have not heard of sludge are much more likely than average to say no to its usage.

- Farm residents who have used sludge in the past are much less likely than average to say no to its usage.

- There is not a significant difference between males and females in willingness to use sludge when sludge has been spread on their own land, or when it has been spread on a neighbor's land.

- For farm residents who have heard of sludge but have not had personal contact (i.e., sludge has not been spread on their land nor on a neighbor's land), males are significantly more willing to use sludge than are females.

- For people who have not heard of sludge, only one out of five women would be willing to have it spread, while slightly less than one half of the males in this category would consent to its use.

- People who live on farms view land application to be primarily a means of helping the cities with their disposal problem. People who do not live on a farm place a proportionally greater value on land application as a means of helping the farmers utilize the fertilizer and soil conditioning properties of sludge.

- Property ownership, place of residence, occupation, and size of farm are not significantly related to reactions to spreading sludge on one's own land; on a neighbor's land; or perceived neighbor's reaction to sludge spreading on one's own land.

- Age and source of sludge information are significantly related to reactions to spreading sludge on one's own land; on a neighbor's land and, perceived reaction of a neighbor to sludge spreading on one's own land. People 65 and older are clearly more unfavorable toward one's own use of sludge and toward a neighbor's use of sludge. Also, people with no source of information on sludge are more unfavorable toward one's own use of sludge and toward a neighbor's use of sludge.

- Sex, personal experience with sludge, and choice of sludge definition are also significantly related to personal sludge reactions. Females are much more negative than males to their reaction to personal usage of sludge, to a neighbor's usage, and in their perception of a neighbor's reaction to their own usage. Farmers who have used sludge have more favorable reactions to their own usage and to a neighbor's usage, than do farmers who have not used sludge. They also perceive neighbors to be more favorable. Farmers who have not heard of sludge react unfavorably to these three items. Finally, people who choose the correct definition of sludge have a more favorable reaction to sludge use.

- People who live on a small farm (i.e., under 100 acres) more strongly agree with Factor 1 - "Sludge is a good source of nitrogen fertilizer" - than do people who live on larger farms.

- Property owners agree to a greater degree with Factor 3 - "Sludge has minimal impacts on water quality, odor, health or prevalence of insects," than do tenants.

- People over 65 and farmers, in general, each agree with Factor 4 - "Sludge has undesirable impacts in the areas of soil compaction, disease and insects, and has minimal usefulness as a soil conditioner."

- People who would allow sludge to be spread on their land: believe that sludge is a good source of nitrogen fertilizer; do not feel as great a need as unwilling people that chemical analysis of the sludge and land should be conducted prior to application; believe that sludge has minimal impacts on water quality, odor, health, or prevalence of insects; do not believe that sludge has undesirable impacts in the areas of soil compaction, disease and insects, and has minimal usefulness as a soil conditioner; and, believe that sludge should not be applied to land used for dairy pasture or on growing crops.

- People who have had sludge spread on their own land hold similar views to those expressed in the previous item, except that their belief that sludge should not be applied to land used for dairy pasture or on growing crops is not as strong as that of groups with less experience.

- People who live on a farm start out with the greatest knowledge about sludge, followed by the non-farm rural group, and then the urban/suburban group.

- The farm group, in addition to starting out with the greatest knowledge, also has the greatest interest in finding out more about sludge.

- "Landscape characteristics to consider in landspreading sludge"; and, "the physical properties of the soil to consider in landspreading," have the greatest current knowledge. However, interest in knowing is not much greater than current knowledge.

- "The presence of disease-causing bacteria in sewage sludge and threat to human health;" and, "the presence of heavy metals in sludge and dangers to crops, animals, and human health" are areas where people have the greatest interest in knowing.

- The question on heavy metals also exhibits the greatest difference between the current knowledge and the interest in knowing means. This is consistent for each of the three places of residence subgroups (i.e., farm, non-farm rural and urban and suburban).

- A large difference between the current knowledge and the interest in knowing means also exists for the farm group for the item on the "legal liabilities of the land owner in landspreading sludge."

- This large difference between the current knowledge and the interest in knowing means also exists for the urban and suburban group for the item on the "threats to wildlife of sludge application on forest and recreational areas."

- The educational program presented to the farm group resulted in significant and favorable attitude changes on 13 of the 18 specific attitudinal questions that this group was questioned about.

- The educational program presented to the non-farm group resulted in significant and favorable attitude changes on 7 of the 8 specific attitudinal questions this group was questioned about.

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